

## CLAIMS

- 1 1. An optical fiber terminator comprising:
  - 2 a) a body exhibiting a substantially uniform
  - 3 refractive index  $n_b$ ;
  - 4 b) an input interface for admitting a light beam
  - 5 from an optical fiber into said body;
  - 6 c) a concave reflective surface provided in said
  - 7 body opposite said input interface for receiving
  - 8 said light beam and reflecting said light beam
  - 9 along a near-normal direction;
  - 10 d) a convex toroidal reflective surface provided in
  - 11 said body for receiving said light beam reflected
  - 12 by said concave reflective surface and reflecting
  - 13 said light beam along an off-normal direction;
  - 14 and
  - 15 e) an output surface for out-coupling said light
  - 16 beam.
- 17  
1 2. The optical fiber terminator of claim 1, wherein
  - 2 an azimuth angle between said near-normal
  - 3 direction and said off-normal direction taken
  - 4 about a rotation axis that connects the point of
  - 5 incidence of said light beam on said concave
  - 6 surface to the point of incidence of said light
  - 7 beam on said convex surface is less than 90
  - 8 degrees.
- 9  
1 3. The optical fiber terminator of claim 1, further
  - 2 comprising a folding mirror surface for
  - 3 reflecting said light beam within said body.
- 4

- 1           4.    The optical fiber terminator of claim 3,  
2                wherein said folding mirror surface is  
3                coated by a reflecting material.  
4
- 1           5.    The optical fiber terminator of claim 3,  
2                wherein said folding mirror surface  
3                comprises a light-conditioning element.  
4
- 1           6.    The optical fiber terminator of claim 1, wherein  
2                said input interface is a surface located  
3                adjacent said convex toroidal reflective surface.  
4
- 1           7.    The optical fiber terminator of claim 1, wherein  
2                said concave reflective surface is a concave  
3                toroidal reflective surface.  
4
- 1           8.    The optical fiber terminator of claim 7,  
2                wherein said convex toroidal reflective  
3                surface and said concave toroidal reflective  
4                surface are adjusted to mutually cancel  
5                wavefront distortions in said light beam.  
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- 1           9.    The optical fiber terminator of claim  
2                8, wherein said convex toroidal  
3                reflective surface and said concave  
4                toroidal reflective surface are  
5                dimensioned to collimate said light  
6                beam.  
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- 1           10.   The optical fiber terminator of claim  
2                8, wherein said convex toroidal  
3                reflective surface and said concave

4                   toroidal reflective surface are  
5                   dimensioned to focus said light beam.  
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1       11. The optical fiber terminator of claim 1, wherein  
2       said body comprises a molding material having a  
3       substantially uniform coefficient of thermal  
4       expansion.  
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1       12. The optical fiber terminator of claim 11,  
2       wherein said molding material is an organic  
3       polymer.  
4

1       13. The optical fiber terminator of claim 11,  
2       wherein said molding material is a glass.  
3

1       14. The optical fiber terminator of claim 1, wherein  
2       said concave reflective surface and said convex  
3       toroidal reflective surface are coated by a  
4       reflecting material on the surface of said body.  
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1       15. The optical fiber terminator of claim 14,  
2       further comprising an optical monitor  
3       coupled to said body for monitoring the  
4       intensity of said light beam.  
5

1       16. The optical fiber terminator of claim  
2       15, wherein said optical monitor is  
3       coupled to one of said concave  
4       reflective surface and said convex  
5       toroidal reflective surface.  
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1       17. The optical fiber terminator of claim 1, further  
2       comprising a light-conditioning element in said  
3       body for conditioning said light beam.

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1       18. The optical fiber terminator of claim 17,  
2       wherein said light conditioning element is a  
3       coating selected from the group consisting  
4       of wavelength-filtering coatings, anti-  
5       reflection coatings, and polarization-  
6       altering coatings.

7  
1       19. The optical fiber terminator of claim 17,  
2       wherein said light conditioning element is a  
3       grating.

4  
1       20. The optical fiber terminator of claim 1, further  
2       comprising a light-conditioning element on a  
3       surface of said body for conditioning said light  
4       beam.

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1       21. The optical fiber terminator of claim 20,  
2       wherein said light conditioning element is a  
3       coating selected from the group consisting  
4       of wavelength-filtering coatings, anti-  
5       reflection coatings, and polarization-  
6       altering coatings.

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1       22. The optical fiber terminator of claim 20,  
2       wherein said light conditioning element is a  
3       grating.

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- 1        23. The optical fiber terminator of claim 1, wherein  
2        said input interface is a surface of said body.  
3
- 1        24. A monolithic fiber terminator array comprised of  
2        a number of optical fiber terminators of claim 1.  
3
- 1        25. An apparatus for manipulating light comprising:  
2        a) a body exhibiting a substantially uniform  
3        refractive index  $n_b$ ;  
4        b) an input interface for admitting a light beam  
5        into said body;  
6        c) a concave reflective surface provided in said  
7        body opposite said input interface for receiving  
8        said light beam and reflecting said light beam  
9        along a near-normal direction;  
10       d) a convex toroidal reflective surface provided in  
11       said body for receiving said light beam reflected  
12       by said concave reflective surface and reflecting  
13       said light beam along an off-normal direction;  
14       and  
15       e) an output surface for out-coupling said light  
16       beam.  
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- 1        26. The apparatus of claim 25, wherein an azimuth  
2        angle between said near-normal direction and said  
3        off-normal direction taken about a rotation axis  
4        that connects the point of incidence of said  
5        light beam on said concave surface to the point  
6        of incidence of said light beam on said convex  
7        surface is less than 90 degrees.  
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- 1 27. The apparatus of claim 25, further comprising a  
2 folding mirror surface for reflecting said light  
3 beam within said body.  
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- 1 28. The apparatus of claim 25, wherein said input  
2 interface is a surface located adjacent said  
3 convex toroidal reflective surface.  
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- 1 29. The apparatus of claim 25, wherein said concave  
2 reflective surface is a concave toroidal  
3 reflective surface.  
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- 1 30. The apparatus of claim 25, wherein said body  
2 comprises a molding material having a  
3 substantially uniform coefficient of thermal  
4 expansion.  
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- 1 31. The apparatus of claim 25, wherein said concave  
2 reflective surface and said convex toroidal  
3 reflective surface are coated by a reflecting  
4 material on the surface of said body.  
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- 1 32. The apparatus of claim 25, further comprising a  
2 light-conditioning element in said body for  
3 conditioning said light beam.  
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- 1 33. The apparatus of claim 25, further comprising a  
2 light-conditioning element on a surface of said  
3 body for conditioning said light beam.  
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- 1 34. The apparatus of claim 25, wherein said input  
2 interface is a surface of said body.

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35. A monolithic array comprised of a number of apparatus of claim 25.
36. A free space communication system comprising the apparatus of claim 25.
37. A telescoping system comprising the apparatus of claim 25.
38. A method for receiving and guiding a light beam, said method comprising:
- a) providing an optical fiber terminator having a body exhibiting a substantially uniform refractive index  $n_b$ ;
  - b) admitting said light beam into said body via an input interface;
  - c) providing a concave reflective surface in said body opposite said input interface for receiving and reflecting said light beam along a near-normal direction;
  - d) providing a convex toroidal reflective surface in said body for receiving said light beam reflected by said concave reflective surface and reflecting said light beam along an off-normal direction; and
  - e) out-coupling said light beam via an output surface of said body.